INSTALLATION MANUAL OF TML BTMC BOLT STRAIN GAUGES

BTMC Bolt Strain Gauges

In case that strain gauges cannot be bonded on the shaft surface of a bolt, the BTMC bolt strain gauge is embedded into a hole drilled at the center of the bolt head with CN adhesive to measure the axial strain of the bolt on tightening. By calibrating the bolt strain gauge embedded into the bolt, you can find accurate tightening axial force of the bolt.

Please also read the operation manual of CN adhesive prior to the installation of BTMC bolt strain gauge.

Cautions for handling CN adhesive
1. Avoid contact with skin, eyes and clothing. 2. Should fingers be bonded, do not forcibly detach but slowly take off, rubbing in a bath. 3. Should adhesive enter eyes, flush eyes well with water and call for medical aid. Never forcibly detach nor rub eyes. 4. Do not use a textile glove in bonding work. 5. Use in a well ventilated area. 6. Handle in a place without flame. 7. Store away from children. 8. May produce an exothermic reaction if large amounts come into contact with fabrics. Beware of burn

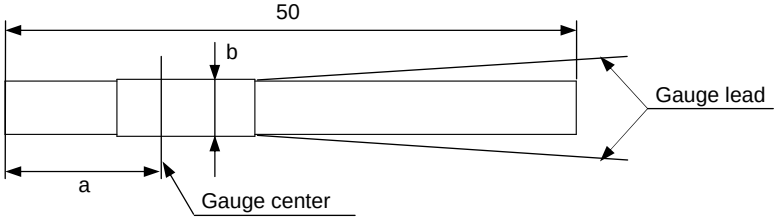
1 Specifications

Table. 1

Type	Gauge length (mm)	Gauge center position (mm) a	Backing diameter (mm) b	Resistance (Ω)	Hole diameter (mm)
BTMC-05-D10-003LE	0.5	5	φ0.9	120	φ1.0
BTMC-1-D16-003LE	1	5	φ1.5	120	φ1.6
BTMC-3-D20-006LE	3	10	φ1.9	120	φ2.0

Gauge lead : Polyimide covered copper wire φ0.10mm
30mm long (BTMC-05-D10-003LE, BTMC-1-D16-003LE)
60mm long (BTMC-3-D20-006LE)

Applicable bolt : Sectional area loss of bolt due to drilling should be within 5%.

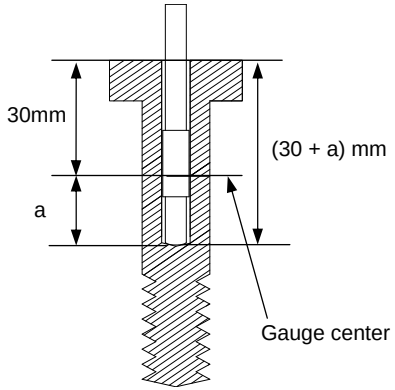


Unit: mm

Fig. 1

2 Drilling Bolt

Depth of the hole should be determined taking the "Gauge Center a" in the Table 1 into consideration. When the gauge center is positioned 30mm below the top of the bolt head for example, the depth of the hole should be (30 + a) mm. (Fig. 2)



This is an example when the distance between the top of the bolt head and the gauge center is 30mm.

Fig. 2

3 Cleaning of Inner Hole

1. Cleaning with solvent (Acetone, etc.)
   Pour a solvent into the hole using a syringe and wash out drilling oil and dust.
2. Wiping off
   Remove remainders in the hole thoroughly with a solvent-dampened tissue which is rolled on a drill bit. Continue it till the tissue comes away clean.
3. Removal of solvent
   Remove the remaining solvent in the inner hole with a clean tissue, etc.

- If drilling oil, dust and/or solvent remain in the hole, curing failure of adhesive may occur.

- Also clean the outside of the bolt such as head and axle.

- Immediately after washing, embed the gauge to avoid contamination with a film of oxide or soil.

4 Pouring of Adhesive

1. Apply the tip nozzle to the nozzle of the CN adhesive container. (Use the exclusive nozzle for a 1mm diameter hole.)
2. Insert the tip nozzle into the hole until the top of the tip nozzle hits the bottom of the hole.

3. Apply the adhesive into the hole while slowly pulling up the tip nozzle. Take care not to leave air bubbles in the hole.
4. Fill the adhesive fully from the bottom to the top of the hole.

- If the amount of adhesive is not sufficient, poor installation may be caused.

- If the amount of adhesive is too much, remove the excess adhesive so that the adhesive keeps the same surface with the bolt head.

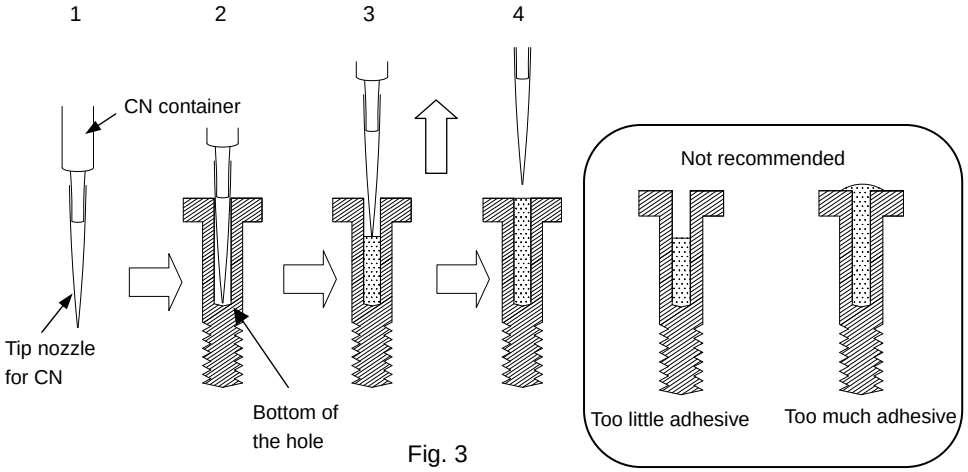


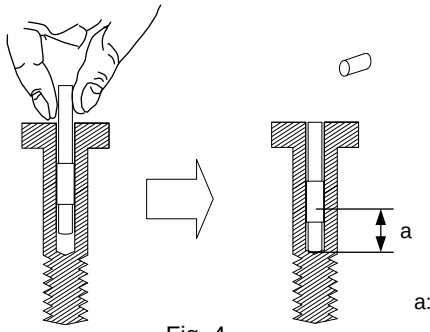
Fig. 3

5 Inserting Gauge

If the hole of the bolt is deeper than 50mm, the position of the gauge is adjusted at the upper side of the gauge.
If the gauge center is positioned deeper than 40mm, consult TML.

A. When the gauge position is adjusted at the bottom of the gauge

1. Immediately after filling the adhesive into the hole, insert the gauge until the bottom of the gauge hits the bottom of the hole.
2. Keep the bolt calm in upright position at room temperature for 1 hour.
3. After the adhesive is cured, cut the pipe extruded from the hole. Pay attention not to damage the gauge leads during this work.
4. After cutting the pipe, install a connecting terminal and connect the gauge lead.



a: Refer to the Table 1

Fig. 4

B. When the gauge position is adjusted at the top of the gauge

1. If the gauge center is positioned 30mm below the bolt head for example, cut the top side of the pipe by 10mm for BTMC-3 or by 15mm for BTMC-05/1.
2. After cutting the pipe, pull out the gauge using tweezers.
3. Fill the hole with CN adhesive.
4. Insert the gauge quickly to a certain depth while holding the upper part of the pipe.
5. Insert the pipe fully using tweezers. During this work, apply a polyethylene sheet between the tweezers and the gauge so as the tweezers do not stick to the gauge or the bolt.
6. Keep the bolt calm in upright position at room temperature for 1 hour.
7. After the adhesive is cured, install a connecting terminal and connect the gauge lead.

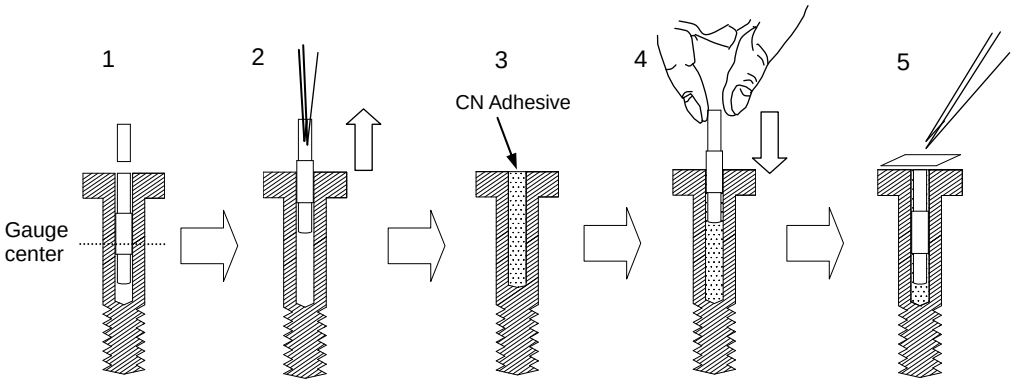


Fig. 5

6 Curing

For precise measurement, leave the bolt for 1 day. Alternatively, leave the bolt for 1 hour at room temperature and then heat it at 80°C for 1 hour.

7 Lead wire connection

Connect an instrumentation lead wire to the connecting terminal after the adhesive is cured.

Bolt strain gauge installation works are acceptable

Installation works of bolt strain gauge include drilling hole on the bolt, installation of bolt strain gauge and calibration with load. For effective use of bolt strain gauges, we accept works of drilling hole on the bolt, installation of bolt strain gauge and calibration with load.
Please contact TML or your local representative for the details.

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